National Aeronautics and Sace Administration

Office of
Small Business Programs (OSBP)
where small business makes a **big** difference

Clark Atlanta University

Research and Development and Technical Support Capabilities

www.nasa.gov

CAU Goals and Team

- Assemble a highly qualified **Team** to provide the government, its contractors, and small and large businesses with Research and Development and Technical Support Services (R&DTSS).
- Deliver outstanding products and services.
- Develop residual technical capability and experience within CAU to respond to future contracts and to provide for the training and production of skilled minority personnel to meet the nations science and engineering manpower needs for the future.
- The **Team** consists of highly qualified faculty, staff, and students and, if necessary, subcontractors that have a history of working with CAU faculty and students.

Relevant Experience/Policies

- CAU and its subcontracts have experience with Task Order Contracts.
- CAU and its subcontractors have policies in place to protect Export Controlled Data and abide to the International Trade Arms Regulations (ITAR). (Several Team members hold security clearances.)
- Examples of Past Performance are in our capabilities statement.
- DUNS No: **06-532-5177** Cage Code: **0MVF5** NACIS ID(s): **611310, 541710, 541720** SIC: **8221, 8732, 8733**
- Federal EIN No: **58-1825259**
- Certificates, Registrations, Accreditations: ***SACSCOC, AACSB, CSWE, CACREP, NSPPAA, NCATE, GAPSC***

Clark Atlanta University

Clark Atlanta University (CAU) is a private, urban, coeducational institution of higher education. The University was established in 1988 through the consolidation of two parent institutions — Atlanta University (1865) and Clark College (1869), the nation's first institution to award graduate degrees to African Americans, and Clark College (1869) the nation's first four-year liberal arts college to serve a primarily African-American student population.

About CAU

- CAU is the largest of the 37 member UNCF colleges, offers undergraduate, graduate and professional, and non-degree certificate programs.

- CAU is classified by Carnegie as a Doctoral/Research University (DRU) and the only private, independent graduate research institution in the HBCU community, and the only HBCU member of the Georgia Research Alliance.

- CAU is accredited by the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) to award the baccalaureate, masters, specialist and doctorate degrees.

- The University offers 38 major areas of study through four schools – Arts and Sciences; Business Administration; Education; and Social Work and awards Bachelor's, Master's, Specialist, and Doctoral degrees.

- Total full-time teaching faculty number = 171, 81% of whom hold terminal degrees; 67% have tenure status. Faculty-student ratio is 1:15.

CAU STEM Degree Offerings

• Biology	B.S.	M.S.	PhD
• Chemistry	B.S.	M.S.	PhD
• Computer and Information Systems*	B.S.		
• Computer Science	B.S.	M.S.	
• Mathematics	B.S.	M.S.	
• Physics	B.S.	M.S.	
• Dual-Degree Engineering (STEM Partner Institution)	B.S.		CAU/Engineering B.S.

* Transforming to Department of Cyber-Physical Systems, which will include new bachelor of science programs in cybersecurity, robotics, and data analytics.

CCRTD/ Biology Lab Capabilities

- Recombinant Protein Production
- Site directed mutagenesis
- Cell sorting and stem cell technology
- Cancer Target discovery, drug development and evaluation (in vitro and in vivo)
- Developing genetically modified cell lines
- Bioinformatics and large scale GWAS data analysis
- DNA, RNA and Protein analysis
- Cell and organ culture
- Histological analysis

Core Lab Equipment

- FACS
- Tissue/ cell culture
- HPLC
- Imaging systems (Fluorescent, Luminescense, visible, UV)
- Microscopes (Confocal, Fluorescence, Live cell imaging, Laser capture Microdissection, whole slide scanner)
- Laser scanners (Multi mode imagers)
- Real time/ multiplex PCR systems
- Centrifuges (high/ Ultra speed)
- Spectrophotometers (plate readers, nano-drop, UV/Vis)
- Bioanalyzer

Funding and Support

- NIH (NCI, NIMHD, NIGMS)
- DoD (CDMRP)
- NSF
- Georgia Research Alliance

Past Performance and Capabilities

The CAU HiPPAC Center was funded as NASA University Research Center (URC) 1992-2012.

NASA NAGW-2939
NASA NCC3-552
NASA NCC3-1044

The CAU HiPPAC Center was a certified vendor for the Lockheed F-22 program.

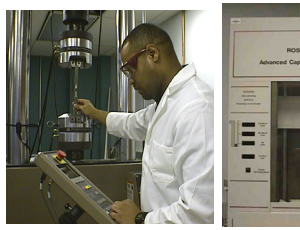
The HiPPAC Center has successfully carried out contracts for Aerospace and Companies.

The NASA URCs were charged to build the infrastructure to meet NASA and NASA contractor needs.

HiPPAC Center Infrastructure

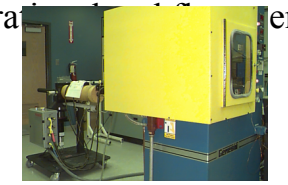
Equipment and Instrumentation

- Center of excellence in composite manufacturing
- Axial and axial-torsion servohydraulic test frames
- Elevated temperature creep frames (composites)
- Ultrasonic NDI and environmental chambers
- Melt and capillary rheometry, extrusion and thermal imaging, compression molding, and thermoforming






- RTM, VARTM, autoclave, walk-in oven, 30T press
- Thermal analysis (TGA, DSC, TMA, DMA)
- Chemical analysis (NMR, FT-IR, Raman, Wet Lab)
- Microscopy (AFM, SEM, XRD)
- Vibra[illegible]er




COMPOSITES PROCESSING

Processing capabilities include autoclave processing, Resin Transfer Molding (RTM), Vacuum Assisted Resin Transfer Molding (VARTM), Thermoforming and Compression Molding techniques. Polymer processing capabilities, including extrusion, batch mixing, blending and alloying.

Composites Processing Capabilities	
Instrument	**Specific Processes**
Wabash Press - Model G30H-15-CPX • 30 Ton • 450°C • 15" x 15" platens	• Compression Molding • Resin Transfer Molding • Powder Coated Textiles
Autoclave - Mini Bonder I • 600 psi • 1000°F • 18" diameter x 40"	• Hand Lay-up • VARTM with A/C
Thermoforming - Hydrotrim Labformer	• Thermoforming • Powder Coated Textiles
Resin Injector – • 550°F • 2000 cc • 500 cc/min	• Resin Transfer Molding
Walk-In Oven – Wisconsin • 800°F • 6'x6'x6'	• RTM • VARTM • Vacuum Bag Oven Curing
Haake Extruder / Mixer • 500°C	• Nano-composites • Sheet and Rod

THERMAL ANALYSIS

The Thermal Analysis Laboratory provides DSC, TGA, DTMA, and TMA. Allows determination of degree of cure, heat of reaction, cure kinetics, and glass transition temperature (T_g).

Thermal Analysis Capabilities	
Instrument	**Specific Tests**
Differential Scanning Calorimeter TA instruments Q 2000 DSC	• Glass Transition Temperature (T_g) • Melting Temperature (T_m) • Crystallization time and temperature • Percent crystalline • Heats of fusion and reaction • Specific heat and heat capacity • Oxidative stability • Cure kinetics
Thermogravimetric Analysis TA instruments Q50 TGA	• Thermal Stability • Thermo-oxidative stability • Decomposition temperature • Degradation kinetics
Thermomechanical Analysis TA instruments Q400 TMA	• CTE • Glass Transition (T_g)
Dynamic Mechanical Analysis | TA instruments AGRS II DMTA	• Modulus (E) • Tan delta • Glass Transition (T_g)

MECHANICAL CHARACTERIZATION

Capabilities include ASTM, SACMA, CMC, and MIL-STD tensile, compression, torsion, flexural, and shear quasi-static as well as high cycle dynamic (fatigue) testing. Long focal length microscope allows for the observation and measurement of cracks and damage in monolithic and composite materials.

Mechanical Characterization Capabilities	
Instrument	**Specific Tests**
• MTS 810 axial and axial-torsional 100 kN servo-hydraulic test frames • 100 kN Instron electro-mechanical test frames • MTS Testar II Controllers • MTS 647 Hydraulic Grips • High Temperature Grips • Surfalloy Wedges • MTS 601 Temp Chamber • Vishay 2100 Conditioners • Capacitance Extensometer • MTT 605 IITRI Fixture • MTT 642.1 Bend Fixture • Wyoming WTF-2R Fixture • Wyoming 605.26A-21 • SACM.00388.30 Fixture	• Un-Notched Tension • Un-Notched Compression • Open Hole Compression • Filled Hole Compression • IITRI Compression • Open Hole Tension • Tension-Tension Fatigue • Tension-Compression Fatigue • Torsion Fatigue • Flexural (Bending) Properties • Fracture Toughness Testing • Crack Growth Measurement • Interlaminar (Short-Beam) Shear • In-and-Out of plane Shear • IOSIPESCU Shear • Elevated Temperature Testing

MECHANICAL CHARACTERIZATION (continued)

• SACM.00188.12 Fixture • BOEI.07260.2 Fixture • Boeing IMP.0011 Impact • Questar QRMS-II/670 • Tenney Benchmaster	• Sub-Zero Testing (-129° C) • Low Velocity Impact Testing • Compression After Impact • Vickers Hardness Testing • Damage Detection/Monitoring • Temperature/Humidity Condition
• SATEC Model D 20kN • SATEC DL 2 kN • TCC Chamber • TCS1200 Controller	• High Temperature Creep Testing • Accelerated Testing • Durability Testing • Viscoelastic Properties

RHEOLOGY

The Rheology lab functions in parallel with the thermal analysis laboratory. Allows determination of the viscoelastic properties of polymeric materials as it relates to molecular structure, processibility, physical properties and end use performance.

Rheology	
Instrument	**Specific Tests**
Rheology TA instruments : AGRS II DMTA	• Melt Rheology • Cure Modeling • Solid State Rheology • Cure Kinetics
Haake Rheocord 90	• Cure Modeling • Mixing
Rosand Capillary Rheometer	• Melt Rheology • Cure Modeling • Solid State Rheology
Kayness Model D7051	• Melt Index

CHEMICAL ANALYSIS

The Chemical Analysis laboratories have the ability to analyze chemical compounds. These labs are important for allowing determination of the chemical make-up of polymer resins used in polymer matrix composites, the determination of side or by-products generated during cure, and miscellaneous trouble shooting into chemistry related problems.

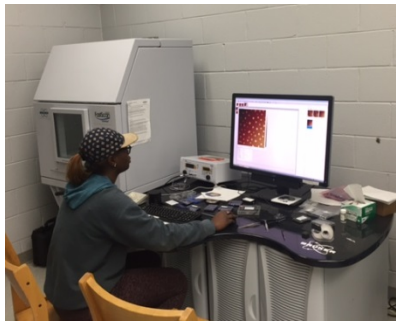
Chemical Analysis Capabilities	
Instrument	**Specific Tests**
FT-IR • Solids • Powders • Fibers • Polymers • Liquids • Thin Films • Gases	• KBr Pellet • Nujol Mull • Ambient Diffuse Reflectance
Ramman Bruker; SENTERRA Raman Microscope; • Powders • Fibers • Polymers • Liquids • Thin Films	• Standard Raman Scattering • 2D and 3D mapping
NMR Bruker 500 ADVANCE III with solid and liquid probes Bruker 400 ADVANCE • Solutions • Multinuclear • Solid State	• 1D & Double resonance • 2-D NMR • Magic Angle Spinning

CHEMICAL ANALYSIS (continued)

X-Ray diffraction Panalytical Empyrean XRD • Powders and Thin Films • Polycrystalline and Nanoporous materials • Nancomposites • Colloidal dispersions • Polymers	• WAXS in reflection and transmission geometry • SAXS in transmission geometry • WAXS and SAXS at non ambient temperature • 2D- SAXS with 3D area detector XRD, SAX, and WAXS • Hot Stage
Surface Analyses Micromeritics ASAP 2020	• BET surface area and Pore size analysis. • Chemisorption
Agilent Chromatography and Mass Spectrometry GC 6890N /MSD 5973N Agilent HPLC with UV and Refractive Index Detectors	• QC/QA • Analysis of complex mixtures of organic components • Analysis of complex mixtures of volatile, semi- and non-volatile organic components
Perkin Elmer DRC-e ICP/MS Elemental(metals) analysis	• Metals analysis to ppb and ppt levels.

CHEMICAL ANALYSIS (continued)

Bruker Dimension FastScan® AFM	• AFM Imaging techniques for fluids • Imaging of polymer latexes and biological samples • Imaging of extremely soft and delicate samples • Quantitative nanomechanical property mapping: • Electrical property including surface potential: Topography, Mechanical property information (deformation, adhesion, DMT modulus, and dissipation). • Variable temperature stage (-35° to 250°C)
Horiba LA550 Particle size analyzer	• Particle size from 1 nm to 6 µm and a concentration range from ppm up to 40% solids



M&P Technologies, Inc.
Affordable Solutions for Advanced Polymers

LOCKHEED MARTIN

Lockheed-Martin Collaborations

P-3 Orion Fairing Fabrication

- Develop, build, and certify low cost composite components for P-3 aircraft
- Replaces corrosion sensitive components on aging aircraft platform with VARTM composites
- First effort within LM Aero to build flight worthy hardware for manned A/C
- Selected component – Aft lower wing fillet panel
- Scope of effort
  - Full scale tooling
  - Design property testing
  - Sub and full scale fabrication
- Program completed in 12 months

Lockheed-Martin Collaborations

F/A-22 Material Screening
Joint Strike Fighter

We have carried out more than 25 contracts for Lockheed Martin Aeronautics

M&P Technologies, Inc.
Affordable Solutions for Advanced Polymers

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NANO-PARTICLE ENHANCED POLYIMIDE MATRIX COMPOSITE (PMC) MATERIALS FOR AEROSPACE

Goddard Space Flight Center

Problem:

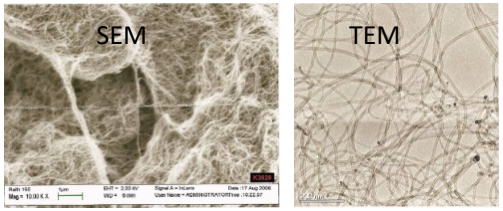
1. Low Electrical Conductivity
2. CTE Mismatch
3. Low Thermal Conductivity in 'z'
4. Moisture Absorption/Out Gassing
5. Dimensional Stability

Benefiters: Aerospace Vehicles and Missiles

Solution: Adding MWCNTs to PMCs

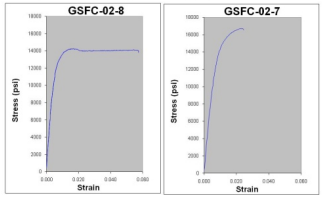
1. Provide Electrostatic Charge Mitigation
2. Tailored CTE
3. Increase Thermal Conductivity in 'z'
4. Decrease Moisture Absorption/Out Gassing
5. Provide Better Dimensional Stability

SEM and TEM Images of as Received MWCNTs



MWCNTs Increased ±45° Strength and Reduced Ultimate Strain Relative to Baseline PMCs.

- [+/- 45] Tension Testing Results (RT)



PMCs also showed up to 13% reduction in CTE with only ~1% loading of MWCNTs.

Current State of Development :

- MWCNTs decreased PMC resistivity 55% with <1% MWCNT
- -> Infers a large effect on electrical conductivity (electrostatic charge mitigation).
- -> Expect similar effect on thermal conductivity (through-thickness).
- All MWCNT PMCs had increased [+/-45] Tensile Strength (up to 10% increase at RT and up to 12% @ -120°F).
- All MWCNT PMCs had reduced Ultimate Strain (up to 57%).
- Achieved 13% reduction in CTE with less than 1% MWCNT.
- Achieved 24 – 37% decrease in moisture absorption (off-gassing).
- Fabricated 1st Article (4 Satellite Test Flexures)

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